

CH-47F IMPROVED CARGO HELICOPTER (ICH)



Army ACAT IC Program

Total Number of Systems:	300
Total Program Cost (TY\$):	\$3.08B
Average Unit Cost (TY\$):	\$9.8M
Full-rate production:	2QFY04

Prime Contractor

Boeing

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2020

The CH-47F Improved Cargo Helicopter (ICH) is a remanufactured version of the CH-47D Chinook cargo helicopter with the new T55-GA-714A engines. The CH-47D is a twin-turbine tandem rotor helicopter designed for combat and combat support heavy-lift cargo missions. The ICH program is intended to sustain the aging CH-47D airframes and extend the aircraft's life expectancy another 20 years. Additional improvements to the ICH include: (1) fuselage stiffening (what will reduce vibrations which is expected to lead to improved reliability and reduced operating and support costs); and (2) integrated cockpit and digital architecture for Force XXI compatibility.

ICH contributes to *dominant maneuver* and *focused logistics* by transporting weapons, ammunition, equipment, troops, and other cargo in general support of combat units and operations other than war.

BACKGROUND INFORMATION

OSD approved entry into Engineering and Manufacturing Development (EMD) for the CH-47F ICH at Milestone I/II in 3QFY98 with an ACAT IC designation. Based on the perceived low risk of development, OSD delegated Milestone Decision Authority to the Army Acquisition Executive in the Acquisition Decision Memorandum dated May 19, 1998. OSD approved a TEMP update on November 6, 1998 following the award of the EMD contract and the DAB decision.

The Army awarded an EMD contract to Boeing Helicopters. Boeing subsequently awarded a subcontract to Rockwell Collins for development of the avionics package. Preliminary and Critical Design Reviews are complete. Currently, EMD activities are under way. IOT&E is scheduled for 2QFY02 and Milestone III is scheduled for 2QFY04.

DOT&E approved an alternate LFT&E plan and concurred with the Army's request for a waiver from full-up, system-level testing in December 1997. The waiver certification to Congress was provided by USD (A&T) in March 1998. A damaged CH-47D aircraft was repaired and will be used as the LFT system-level Ground Test Vehicle (GTV).

TEST & EVALUATION ACTIVITY

During pre-EMD testing, the program office, in cooperation with Boeing and the Aviation Technical Test Center, demonstrated the anticipated benefits of several ICH product enhancements on a prototype aircraft. The Vibration Reduction Test Aircraft (VRTA) was a modified CH-47D with prototype ICH airframe stiffeners, -714A engines, and modified aft pylon. Vibration flight testing of the VRTA demonstrated that it is possible to lower the CH-47's three-per-revolution lateral first harmonic by approximately 60 percent in the cockpit area. Stiffening also lowered the vertical second harmonic of six-per-revolution in the cockpit by about 50 percent. The -714A engines have been flight tested in the VRTA and qualified for use in the ICH. In a demonstration orchestrated by the program office, soldiers from the 160th Special Operations Aviation Regiment removed and reinstalled the modified aft pylon of the VRTA. In this transportability demonstration, the modifications to the aft pylon significantly reduced the time (from 5:30 hours to 2:05 hours) and effort (from 44 man-hours to 19 man-hours) to prepare the ICH for air transport compared to the CH-47D.

The Live Fire Test program started in 2QFY99. The program has prepared three event design plans for testing and for modeling and simulation, and four detail test plans that describe the testing for the Cockpit Skin Panels, Cockpit Components, Fuel Sub-system and Propulsion/Engine Sub-systems. Fire Detection/Suppression System and Tunnel Hydraulics Test Plans are in preparation for tests scheduled to begin in FY01.

The program initiated ballistic testing of the Cockpit Skin Panels in 3QFY99 and completed 164 of 195 shots. Testing of the T55 engine and fuel sub-system started in 2QFY00. Cockpit component testing is scheduled to begin during 3QFY01.

Testing of the T55 engine and the fuel sub-system included both controlled damage dynamic simulations on the CH-47D GTV and ballistic tests on actual components. More than 40 controlled damage tests on the T55 engines of the GTV have been completed to date. The fuel sub-system tests performed to date include 12 controlled damage tests on the GTV, 24 ballistic tests on four actual

components installed in a surrogate CH-47A fuselage section simulating operational fuel flow conditions in the components, and 3 tests of these components in the GTV with engines and rotors running.

In addition, as part of the DOT&E Joint Live Fire program, eight static tests were conducted for the CH-47D rotor blades, which are the same as those of the F-model. Therefore, these data are directly applicable to the LFT&E of the CH-47F. Quasi-static testing of the blades is scheduled to start in FY01.

TEST & EVALUATION ASSESSMENT

It is highly probable that the service will be able to deliver the expected system performance within the current budget and schedule. If the program proceeds as planned, the proposed integrated test program should provide sufficient data to support a preliminary assessment of the operational effectiveness and suitability of the CH-47F with 130 hours of developmental and 90 operational test flight hours. However, there are some areas of concern.

From a technical perspective, the two primary development areas are low risk. Avionics upgrades will rely largely on non-developmental components and systems designed, manufactured, and integrated by Rockwell Collins. Their avionics package has already been fielded on the MH-47D and MH-60L helicopters and operated by the Army's 160th Special Operations Aviation Regiment. Likewise, airframe stiffening of the VRTA aircraft has already demonstrated sufficient reductions in vibration levels. The remaining challenge will be to integrate these solutions into the production aircraft without inducing unanticipated software failures or unintended weight growth.

From an operational perspective, it will be a challenge for the Army to demonstrate the operational benefits of the digital cockpit. In operational testing of the UH-60Q, the digital cockpit provided a significant improvement in the pilot's awareness of his position with respect to the route and final objective. In operational testing of the MH-60K also with a digital cockpit, navigation accuracy exceeded 98 percent. To date, the Army's System Evaluation Plan does not describe how the benefits of navigation enhancements, moving map displays, interfaces with the Tactical Internet, tactical situational awareness, and integration with other digital battlefield systems will be operationally demonstrated.

From a suitability perspective, the evaluator anticipates that the aircraft will achieve reliability and maintainability (R&M) estimates with 70 percent confidence by the end of IOT&E. Following IOT&E, the program anticipates approximately 1,000 flight hours of R&M data will be collected during the training and fielding of the first unit equipped to complete the evaluation. The follow-on R&M data collection will not be completed in time to support the MS III decision but is critical to demonstrating the anticipated reliability and maintainability improvements.

Even with follow-on R&M data, we will not have enough information to accurately estimate long-term Operations and Support (O&S) costs for this aircraft. To the extent that R&M drives O&S costs, we will have initial indications. Other O&S cost drivers such as the quality of maintenance performed in fielded units, costs of spares, and Army O&S funding levels will not be understood until much later after fielding. It is unlikely the test program will confirm or refute the anticipated O&S savings.

Lastly, the CH-47F LFT&E is a fairly robust program. Ample test data from the Army's LFT of the CH-47F and the DOT&E JLF program of the basic CH-47D are expected to provide a good evaluation of the CH-47F. The only LFT&E concern at this time is that the dynamic testing of the main rotor blades (under the JLF program) may not occur prior to the Milestone III decision due to the fact that

the same helicopter will be used to support earlier LFT of other components unique to the CH-47F. In addition, the GTV may not be viable at the completion of the LFT.